



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : C12N 15/82, 15/11, 5/10, A01H 5/00		A3	(11) International Publication Number: WO 97/10328
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(21) International Application Number: PCT/US96/11689		IN 46032 (US). MERLO, Donald, J. [US/US]; 11845 Durbin Drive, Carmel, IN 46032 (US).	
(22) International Filing Date: 12 July 1996 (12.07.96)		(74) Agents: WARBURG, Richard, J. et al.; Lyon & Lyon, First Interstate World Center, Suite 4700, 633 West Fifth Street, Los Angeles, CA 90071-2066 (US).	
(30) Priority Data: 60/001,135 13 July 1995 (13.07.95) US		(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).	
(71) Applicants (for all designated States except US): RIBOZYME PHARMACEUTICALS, INC. [US/US]; 2950 Wilderness Place, Boulder, CO 80301 (US). DOWELANCO [US/US]; 9330 Zionville Road, Indianapolis, IN (US).		Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.	
(72) Inventors; and (75) Inventors/Applicants (for US only): ZWICK, Michael, G. [US/US]; 4138 Joni Lane, Loveland, 80537 (US). EDINGTON, Brent, E. [US/US]; 2955 Glenwood Drive #201, Boulder, CO 80301 (US). McSWIGGEN, James, A. [US/US]; 4866 Franklin Drive, Boulder, CO 80301 (US). MERLO, Patricia, Ann, Owens [US/US]; 11845 Durbin Drive, Carmel, IN 46032 (US). GUO, Lining [US/US]; 7 Nelson Circle, Brownsburg, IN 46112 (US). SKOKUT, Thomas, A. [US/US]; 2539 Sutton Avenue, Carmel, IN 46032 (US). YOUNG, Scott, A. [US/US]; 5329 Holly Springs Drive East, Indianapolis, IN 46254 (US). FOLKERTS, Otto [US/US]; 159 Red Oak Lane, Carmel,		(88) Date of publication of the international search report: 15 May 1997 (15.05.97)	
(54) Title: COMPOSITIONS AND METHOD FOR MODULATION OF GENE EXPRESSION IN PLANTS			
(57) Abstract An enzymatic nucleic acid molecule with RNA cleaving activity, wherein said nucleic acid molecule modulates the expression of a gene in a plant. A transgenic plant comprising nucleic acids encoding for an enzymatic nucleic acid molecule with RNA cleaving activity, wherein said nucleic acid molecule modulates the expression of a gene in said plant.			

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 96/11689

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 6 C12N15/82 C12N15/11 C12N5/10 A01H5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC 6 C12N A01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 416 572 A (HOECHST AG) 13 March 1991	1-6, 9-11, 14, 15, 45-55, 63-67, 73, 74, 77-79, 82-87, 90, 93, 94 7, 8
Y	see the whole document ---	
Y	EP 0 360 257 A (UNIV ILLINOIS ; BIOTECHNOLOGY RES & DEV CORP (US)) 28 March 1990 see the whole document ---	7
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

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- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- *&* document member of the same patent family

Date of the actual completion of the international search

17 January 1997

Date of mailing of the international search report

17.04.97

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
 Fax (+31-70) 340-3016

Authorized officer

MADDOX, A

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 96/11689

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 92 13090 A (GEN HOSPITAL CORP) 6 August 1992 see page 32, line 35 - page 33, line 5 ---	8
X	WO 93 02197 A (NICKERSON BIOCEM LIMITED) 4 February 1993 see example 8 ---	1-6, 9-11, 14, 15, 45-55, 63-67, 73, 74, 77-79, 82-90, 93, 94
X	WO 91 13972 A (CALGENE INC) 19 September 1991 see page 14, line 11 - line 38 ---	1, 16-18, 37-40, 53-58, 68-70, 81
A	PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF USA, vol. 89, 1992, WASHINGTON US, pages 2624-2628, XP002022969 KNUTZON, D.S., ET AL.: "Modification of Brassica seed oil by antisense expression of a stearyl-acyl carrier protein desaturase gene" see the whole document ---	1, 16-18
A	WO 95 06128 A (DEKALB GENETICS CORP) 2 March 1995 see page 43, line 1 - page 44, line 5 see page 51, line 1 - page 52, line 15 ---	1, 2, 57, 69, 75, 76
A	MOLECULAR AND GENERAL GENETICS, vol. 245, 1994, pages 465-470, XP002022959 WEGENER, D., ET AL.: "Expression of a reporter gene is reduced by a ribozyme in transgenic plants" see the whole document ---	1
A	WO 94 00012 A (GENE SHEARS PTY LTD ; ATKINS DAVID G (AU); GERLACH WAYNE L (AU); YO) 6 January 1994 see claims 1-4 ---	8
A	EP 0 321 201 A (COMW SCIENT IND RES ORG) 21 June 1989 see the whole document ---	48, 88
4 A	WO 91 18985 A (DU PONT) 12 December 1991 see page 7, line 24 - line 32 ---	37
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INTERNATIONAL SEARCH REPORT

Internal Application No.

PCT/US 96/11689

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>PLANT MOLECULAR BIOLOGY, vol. 26, 1994, pages 1758-1773, XP002021172 KUIPERS, A.G.J., ET AL.: "Field evaluation of transgenic potato plants expressing an antisense granule-bound starch synthase gene: increase of the antisense effect during tuber growth" -----</p>	

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 96/11689

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see continuation-sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

16-18, 37-40, 53-58, 68-70, 81 all completely and 1-15, 45-52, 63-67,
73-79, 82-90, 93, 94 all partially

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US 96/ 11689

FURTHER INFORMATION CONTINUED FR M PCT/ISA/210

1. Claims: 16-18,37-40,53-58,68-70,81 all completely and 1-15, 45-52,63-67,73-79,82-90,93,94 all partially. Method for modulation of fatty acid biosynthesis using delta 9 desaturase ribozymes.
2. Claims: 19-21,41-44,59-62,71,72,80 all completely and 1-15,45-52,63-67,73-79,82-90,93,94 all partially. Method for modulation of starch biosynthesis using granule bound starch synthase ribozymes.
3. Claims: 22-24, all completely and 1-15,45-52,63-67,73-79,82-90,93,94 all partially. Method for modulation of caffeine biosynthesis using 7-methylguanosine and 3-methyl transferase ribozymes.
4. Claims: 25-27 all completely and 1-15,45-52,63-67,73-79,82-90,93,94 all partially. Method for modulation of nicotine biosynthesis using N-methylputrescine oxidase and putrescine N-methyltransferase ribozymes.
5. Claims: 28-30 all completely and 1-15,45-52,63-67,73-79,82-90,93,94 all partially. Method for modulation of fruit ripening using ethylene forming enzyme, pectin methyltransferase, pectin esterase, polygalacturonase, 1-aminocyclopropane carboxylic acid synthase, and ACC oxidase ribozymes.
6. Claims: 31-33, all completely and 1-15,45-52,63-67,73-79,82-90,93,94 all partially. Method for modulation of flower pigmentation using chalcone synthase, chalcone flavone isomerase, phenylalanine ammonia lyase, dihydroflavonol hydroxylases, and dihydroflavonol reductase ribozymes.
7. Claims: 34-36, all completely and 1-15,45-52,63-67,73-79,82-90,93,94 all partially. Method for modulation of lignin production using O-methyltransferase, cinnamoyl-CoA:NADPH reductase and cinnamoyl alcohol dehydrogenase ribozymes.
8. Claims: 91 completely. Transgenic maize plant to alter lipid composition created by a method using antisense delta 9 desaturase gene from maize.
9. Claims: 92 completely. Transgenic maize plant to alter starch composition created by a method using antisense granule bound starch synthase gene from maize.
10. Claims: 95 completely. Vector for plant transformation of fig. 42 (pDAB367).

INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/US 96/11689

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0416572 A	13-03-91	DE 3929741 A AT 122719 T AU 634575 B AU 6218690 A CA 2024720 A DE 59009087 D ES 2074105 T JP 3108484 A	28-03-91 15-06-95 25-02-93 14-03-91 08-03-91 22-06-95 01-09-95 08-05-91
EP 0360257 A	28-03-90	AT 145239 T AU 2850395 A AU 641900 B AU 4159489 A AU 4420793 A DE 68927456 D DE 68927456 T EP 0700996 A ES 2095210 T JP 3123485 A US 5527895 A	15-11-96 28-03-96 07-10-93 29-03-90 02-12-93 19-12-96 20-03-97 13-03-96 16-02-97 27-05-91 18-06-96
WO 9213090 A	06-08-92	AU 654330 B AU 1234492 A CA 2100068 A CN 1065682 A EP 0567568 A HU 69966 A JP 6504444 T NZ 241310 A	03-11-94 27-08-92 18-07-92 28-10-92 03-11-93 28-09-95 26-05-94 28-03-95
WO 9302197 A	04-02-93	AU 2361492 A CA 2114008 A EP 0595981 A HU 69640 A JP 6509231 T SK 7494 A	23-02-93 04-02-93 11-05-94 28-09-95 20-10-94 05-01-95
WO 9113972 A	19-09-91	EP 0472722 A	04-03-92
WO 9506128 A	02-03-95	AU 7716994 A	21-03-95

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 96/11689

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9506128 A		CA 2170260 A EP 0721509 A ZA 9406488 A	02-03-95 17-07-96 30-11-95
WO 9400012 A	06-01-94	AU 4545093 A CA 2137161 A EP 0652705 A FI 946121 A HU 71929 A JP 8500971 T NO 945018 A	24-01-94 06-01-94 17-05-95 28-12-94 28-02-96 06-02-96 23-12-94
EP 0321201 A	21-06-89	AT 115999 T AU 632993 B AU 2800789 A WO 8905852 A BG 51160 A CN 1033838 A DE 3852539 D DE 3852539 T EP 0640688 A ES 2065919 T HU 9500362 A IL 88683 A JP 3502638 T US 5543508 A US 5574143 A US 5589580 A US 5254678 A US 5494814 A	15-01-95 21-01-93 19-07-89 29-06-89 15-02-93 12-07-89 02-02-95 04-05-95 01-03-95 01-03-95 28-09-95 27-11-95 20-06-91 06-08-96 12-11-96 31-12-96 19-10-93 27-02-96
WO 9118985 A	12-12-91	AT 110778 T AU 659087 B AU 7900991 A DE 69103753 D DE 69103753 T EP 0537178 A US 5443974 A	15-09-94 11-05-95 31-12-91 06-10-94 02-02-95 21-04-93 22-08-95